PATENT ABSTRACTS OF JAPAN

(11)Publication number： 2004-064115

(43)Date of publication of application： 26.02.2004

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(51)Int.Cl. H04N 1/41
H03M 7/30
H04N 7/30

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(54) CODE AMOUNT CONTROL APPARATUS AND PROGRAM

(57)Abstract:

PROBLEM TO BE SOLVED: To provide a code amount control apparatus capable of executing code amount control applied to a bit stream including compression encoding data at high speed with less computational complexity so as to suppress distortion with respect to a rate.

SOLUTION: In the code amount control apparatus 1, an MMU 3 temporarily stores an input bit stream including compression encoded data subjected to compression encoding by the JPEG 2000 system into a storage device 2, reads data OD from the storage device 2 according to control signals CS1, CS2 and outputs the data to a multiplexer section 5. The multiplexer section 5 multiplexes the data OD and outputs the multiplexed data as an output bit stream. A bit truncation control section 4 is provided with an image quality control section 10 for selecting an encoding object in conformity with the target

image quality and an encoded amount control section 11 for controlling the encoded amount in conformity with the target encoding amount. A layer division control section 7 outputs a read control signal CS2 to generate an output bit stream divided into a plurality of layers to the MMU 3.

LEGAL STATUS [Date of request for examination] 19.07.2005
[Date of sending the examiner's decision of rejection]
[Kind of final disposal of application other than the examiner's decision of rejection or application converted registration]
[Date of final disposal for application]
[Patent number]
[Date of registration]
[Number of appeal against examiner's decision of rejection]
[Date of requesting appeal against examiner's decision of rejection]
[Date of extinction of right]

2.**** shows the word which can not be translated.

3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]

[Claim 1]

It is the amount control unit of signs which controls the amount of signs of the compression image data compressed by carrying out band division of the picture signal recursively for a high-frequency component and a low-pass component by wavelet transform, computing the transform coefficient of two or more band components, and carrying out entropy code modulation of this transform coefficient,

The image quality control section which chooses the candidate for coding from said band component which carried out the bit shift according to target image quality while only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned to said each band component of said compression image data,

The amount control unit of signs characterized by preparation ******.

[Claim 2]

It is the amount control unit of signs which has a function using said priority which is the amount control unit of signs according to claim 1, and was carried out in weighting as which said image quality control section considered human being's vision property.

[Claim 3]

It is the amount control device of signs which has the function in which are the amount control device of signs according to claim 1 or 2, and said image quality control section determines said candidate for coding in said bit plane unit.

[Claim 4]

It is the amount control unit of signs which has the function in which are the amount control unit of signs given in any 1 term of claims 1-3, and said image quality control section determines said candidate for coding per said coding pass.

[Claim 5]

It is the amount control unit of signs which controls the amount of signs of the compression image data compressed by carrying out band division of the picture signal recursively for a high-frequency component and a low-pass component by

wavelet transform, computing the transform coefficient of two or more band components, and carrying out entropy code modulation of this transform coefficient,

While only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned to said each band component of said compression image data The amount control section of signs controlled to compute the cut-off point which suits the amount of target signs, and to make said sign train before the cut-off point concerned output from the sign train which rearranged the coded data of said band component which carried out the bit shift in order of the predetermined scan, and generated it,

The amount control unit of signs characterized by preparation ******.

[Claim 6]

It is the amount control unit of signs according to claim 5,

said amount control section of signs -- said coded data -- order with said high priority -- and said amount control unit of signs which was turned to the low-pass side from the high region side in said same priority and which rearranges in

order of a scan and generates said sign train.

[Claim 7]

It is the amount control unit of signs given in any 1 term of claims 1-6,

The layer division control section controlled to divide into two or more layers said band component which carried out the bit shift while only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned to said each band component of said compression image data,

Furthermore, the amount control unit of signs which it has.

[Claim 8]

It is the amount control unit of signs which has a function using said priority which is the amount control unit of signs according to claim 7, and was carried out in weighting as which said layer division control section considered human being's vision property.

[Claim 9]

It is a program for controlling the amount of signs of the compression image data compressed by carrying out band division of the picture signal recursively for a

high-frequency component and a low-pass component by wavelet transform, computing the transform coefficient of two or more band components, and carrying out entropy code modulation of this transform coefficient,

As the image quality control section which chooses the candidate for coding from said band component which carried out the bit shift according to target image quality while only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned to said each band component of said compression image data,

The program characterized by operating a microprocessor.

[Claim 10]

It is the program as which said microprocessor is operated with being a program according to claim 9 and said priority carried out in weighting in consideration of human being's vision property being used for said image quality control section.

[Claim 11]

It is the program as which said microprocessor is operated with being a program according to claim 9 or 10, and said image quality control section determining said candidate for coding in said bit plane unit.

[Claim 12]

It is the program as which said microprocessor is operated with being a program given in any 1 term of claims 9-11, and said image quality control section determining said candidate for coding per said coding pass.

[Claim 13]

It is a program for controlling the amount of signs of the compression image data compressed by carrying out band division of the picture signal recursively for a high-frequency component and a low-pass component by wavelet transform, computing the transform coefficient of two or more band components, and carrying out entropy code modulation of this transform coefficient,

While only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned to said each band component of said compression image data As the amount control section of signs controlled to compute the cut-off point which suits the amount of target signs, and to make said sign train before the cut-off point concerned output from the sign train which rearranged the coded data of said band component which carried out the bit shift in order of the predetermined scan, and

generated it,

The program characterized by operating a microprocessor.

[Claim 14]

It is a program according to claim 13,

said amount control section of signs -- said coded data -- order with said high priority -- and the program as which said microprocessor is operated with rearranging in order of said scan turned to the low-pass side from the high region side in said same priority, and generating said sign train.

[Claim 15]

It is a program given in any 1 term of claims 9-14,

As the layer division control section controlled to divide into two or more layers said band component which carried out the bit shift while only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned to said each band component of said compression image data,

The program as which said microprocessor is operated.

[Claim 16]

It is the program as which said microprocessor is operated with being a program according to claim 15 and said priority carried out in weighting in consideration of human being's vision property being used for said layer division control section.

DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention]

This invention relates to the amount control unit of signs which controls the amount of signs of a bit stream including a compression picture signal.

[0002]

[Description of the Prior Art]

It is decided upon JPEG2000 (Joint Photographic Experts Group 2000) method by ISO (International Organization for Standardization) and ITU-T (International Telecommunications Union telecommunication standardization section) as a low bit rate coding method of the next generation of image data. JPEG2000 method has the description in the point which has the function which was excellent compared with the JPEG (Joint Photographic Experts Group) method of the current mainstream, adopts DWT (discrete wavelet transform; Discrete Wavelet Transform) as orthogonal transformation, and adopts the approach of calling EBCOT (Embedded Block Coding with Optimized Truncation) accompanied by bit plane coding as entropy code modulation.

[0003]

The compression coding procedure of JPEG2000 method is outlined referring to the compression coding equipment (encoder) 100 shown in drawing 23 hereafter.

[0004]

After DC level conversion is performed to the picture signal inputted into this compression coding equipment 100 if needed in DC level shift section 102, it is outputted to the color space conversion section 103. Next, the color space conversion section 103 changes the color space of the signal inputted from DC level shift section 102. Next, the picture signal inputted from the color space conversion section 103 is divided into the field component called the "tile" of the shape of two or more rectangle, and the tiling section 104 outputs it to the DWT section 105. The DWT section 105 gives DWT of integer type or real type per tile to the picture signal inputted from the tiling section 104, and outputs the transform coefficient obtained as a result. In DWT, the 1-dimensional filter divided into a high-frequency component (high-frequency component) and a low-pass component (low frequency component) is applied to a perpendicular direction and horizontal order to a two-dimensional picture signal. By the basic method of JPEG2000, the octave division method which carries out band division only of the band component divided into the low-pass side recursively is

adopted as both directions of a perpendicular direction and a horizontal direction. Moreover, the count which carried out band division recursively is called decomposition level (decomposition level).

[0005]

Drawing 24 is the mimetic diagram showing the two-dimensional image 120 to which DWT of the decomposition level 3 was given according to an octave division method. In decomposition level 1, to a perpendicular direction and a horizontal direction, the two-dimensional image 120 is carrying out sequential application of the above-mentioned 1-dimensional filter, and is divided into four band components, HH1, HL1, LH1, and LL1 (not shown). Here, "H" shows a high-frequency component and "L" shows the low-pass component, respectively. For example, HL1 is a band component which consists of the horizontal high-frequency component H and the vertical low-pass component L in decomposition level 1. Generalizing the notation, "XYn" (any of H and L or;n is X and Y is one or more integers) shall point out the band component which consists of the horizontal band component X and the vertical band component Y in the decomposition level n.

[0006]

Next, on the decomposition level 2, band division of the low-pass component LL 1 is carried out HH2, HL2, LH2, and LL2 (not shown). Furthermore, on the decomposition level 3, band division of the low-pass component LL 2 is carried out HH3, HL3, LH3, and LL3. Drawing 24 arranged the band components HH1-LL3 generated above.

[0007]

Next, the quantization section 106 has the function which forms into a scalar quantity child the transform coefficient outputted from the DWT section 105 if needed. Moreover, the quantization section 106 also has the function to perform bit shift processing over which priority is given to the image quality of the appointed field (ROI;Region Of Interest) by the ROI section 107. In addition, when performing reversible (loss loess) conversion, scalar quantity child-ization in the quantization section 106 is not performed. By JPEG2000 method, two kinds of quantization means of the formation of a scalar quantity child in this quantization section 106 and the postquantization (truncation) mentioned later are prepared.

[0008]

Next, entropy code modulation of the block base is given to the transform

coefficient outputted from the quantization section 106 one by one in the multiplier bit modeling section 108 and the algebraic-sign-ized section 109, and it has a rate controlled by the amount control section 110 of signs according to above-mentioned EBCOT. The multiplier bit modeling section 108 is divided into the field which calls the band component of a transform coefficient to input 32x32 and about 64x64 "a code block", and, specifically, decomposes each code block into two or more bit planes which consist of two-dimensional arrays of each bit further.

[0009]

Drawing 25 is the mimetic diagram showing two or more code blocks 121, 121, and 121 and the two-dimensional image 120 disassembled into --. Moreover, drawing 26 is the mimetic diagram showing bit plane 1220-122n-1 (n: natural number) of n sheets which constitutes this code block 121. the bit which constitutes this binary value 123 when the binary value 123 of the transform coefficient of one point under code block 121 is "011--0", as shown in drawing 26 -- respectively -- bit plane 122n-1,122n-2,122n- it is decomposed so that it may belong to 3, --, 1220. Bit plane 122n-1 in drawing expresses the top bit plane which consists only of the most significant bit (MSB) of a transform coefficient,

and the bit plane 1220 expresses the lowest bit plane which consists only of the least significant bit (LSB).

[0010]

Furthermore, the multiplier bit modeling section 108 performs the context (context) judging of each bit in each bit plane 122k (k= 0 to n-1), and as shown in drawing 27 , it decomposes bit plane 122k into three kinds of coding pass (CLeanup pass), i.e., CL pass, MR pass (Magnitude Refinement pass), and SIG pass (SIGnificance propagation pass) according to the significance (judgment result) of each bit. The algorithm of the context judging about each coding pass is defined by the specification of JPEG2000. According to it, the thing in the condition that it turns out that an attention multiplier is not zero in old coding processing with "it is significant" is meant, and the thing in the condition that a multiplier value may be zero with "it is significant and there is nothing", or it may be zero is meant.

[0011]

The multiplier bit modeling section 108 performs bit plane coding with three kinds of coding pass, SIG pass (coding pass of the multiplier which has a significant multiplier in a perimeter and which is not significant), MR pass (coding

pass of a significant multiplier), and CL pass (SIG pass, coding pass of the remaining multiplier information which does not correspond to MR pass). The bit of each bit plane is scanned by 4 bitwises, bit plane applying it to the lowest bit plane from the top bit plane, and it is performed by judging whether a significant multiplier exists. It is significant, and the number of the bit planes which consist of only multipliers (0 bit) which are not is recorded on a packet header, and coding with a significant multiplier actual from the bit plane which appeared first is started. The bit plane of the coding initiation is encoded only with CL pass, and sequential coding of the low-ranking bit plane is carried out with the three above-mentioned kinds of coding pass rather than the bit plane concerned.

[0012]

Next, the algebraic-sign-ized section 109 performs algebraic-sign-ization per coding pass to the multiplier train from the multiplier bit modeling section 108 based on the judgment result of a context using MQ coder. In addition, there is also the mode in which bypass processing which does not make a part of multiplier train inputted from the multiplier bit modeling section 108 algebraic-sign-ize in this algebraic-sign-ized section 109 is performed.

[0013]

Next, the amount control section 110 of signs is performing postquantization which omits the low order bit plane of the sign train which the algebraic-sign-ized section's 109 outputted, and controls the amount of the last signs. And the bit stream generation section 111 generates the bit stream which multiplexed the sign train which the amount control section 110 of signs outputted, and additional information (header information, a layer configuration, scalability, quantization table, etc.), and outputs it as a compression image.

[0014]

[Problem(s) to be Solved by the Invention]

The amount of the last signs etc. was controlled by the above-mentioned compression coding equipment 100 using a rate and distortion optimization (R-D optimization) to optimize the deformation amount to a coding rate. A rate and distortion optimization are performed using the deformation amount in each coding pass calculated in the phase of the above-mentioned algebraic-sign-izing etc. It is indicated by the reference (it is hereafter called Bibliography A.) of "David S.Taubman and Michael W.Marcellin, and "JPEG2000 IMAGE COMPRESSION FUNDAMENTALS and STANDARDS AND PRACTICE" Kluwer Academic Publishers" about the algorithm of a rate and distortion

optimization.

[0015]

On the other hand, in digital instruments, such as a digital camera, image quality, image size, the amount of signs, scalability (hierarchy), etc. of image data may be changed. [finishing / compression] In this case, the amount of signs, scalability, etc. of a compression image were changed using the transformer coder. Although the scalability, amount of signs, etc. can be changed by JPEG2000 method, without decrypting a compression picture signal, after decrypting a compression picture signal, in order to have to change the scalability and amount of signs and once to have to perform compression coding by the conventional JPEG base-line method, there are many amounts of operations and real time nature is low.

[0016]

Therefore, scalability, the amount of signs, etc. of compression coded data in the bit stream generated with compression coding equipment 100 by using the transformer coder of JPEG2000 method can be changed in the small amount of operations. However, since the transformer coder of JPEG2000 method cannot know the deformation amount computed with compression coding equipment

100, it has the problem that the amount control of signs of a bit stream cannot be easily performed using a rate and distortion optimization. Though the transformer coder which performs the amount control of signs using a rate and distortion optimization even if is realizable, the amount of operations of the amount control processing of signs becomes great, and the real time nature becomes low.

[0017]

The place which this invention makes a technical problem in view of the above problem etc. is in the point of offering the amount control unit of signs which is the small amount of operations and can be performed at a high speed so that distortion of as opposed to a rate for the amount control of signs of the bit stream containing compression coded data can be controlled.

[0018]

[Means for Solving the Problem]

In order to solve the above-mentioned technical problem, invention concerning claim 1 The transform coefficient of two or more band components is computed by carrying out band division of the picture signal recursively for a high-frequency component and a low-pass component by wavelet transform.

Are the amount control device of signs which controls the amount of signs of the compression image data compressed by carrying out entropy code modulation of this transform coefficient, and said each band component of said compression image data is received. While only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned, it is characterized by having the image quality control section which chooses the candidate for coding according to target image quality from said band component which carried out the bit shift.

[0019]

Invention concerning claim 2 is the amount control unit of signs according to claim 1, and said image quality control section has a function using said priority carried out in weighting in consideration of human being's vision property.

[0020]

Invention concerning claim 3 is the amount control device of signs according to claim 1 or 2, and said image quality control section has the function to determine said candidate for coding in said bit plane unit.

[0021]

Invention concerning claim 4 is the amount control unit of signs given in any 1 term of claims 1-3, and said image quality control section has the function to determine said candidate for coding per said coding pass.

[0022]

Next, invention concerning claim 5 computes the transform coefficient of two or more band components by carrying out band division of the picture signal recursively for a high-frequency component and a low-pass component by wavelet transform. Are the amount control device of signs which controls the amount of signs of the compression image data compressed by carrying out entropy code modulation of this transform coefficient, and said each band component of said compression image data is received. While only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned It is characterized by having the amount control section of signs controlled to compute the cut-off point which suits the amount of target signs, and to make said sign train before the cut-off point concerned output from the sign train which rearranged the coded data of said band component which carried out the bit shift in order of the predetermined

scan, and generated it.

[0023]

invention concerning claim 6 -- the amount control device of signs according to claim 5 -- it is -- said amount control section of signs -- said coded data -- order with said high priority -- and it rearranges in order of said scan turned to the low-pass side from the high region side in said same priority, and said sign train is generated.

[0024]

Invention concerning claim 7 is the amount control device of signs given in any 1 term of claims 1-6, and it is further equipped with the layer division control section controlled to divide into two or more layers said band component which carried out the bit shift while only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned to said each band component of said compression image data.

[0025]

And invention concerning claim 8 is the amount control unit of signs according to claim 7, and said layer division control section has a function using said priority

carried out in weighting in consideration of human being's vision property.

[0026]

Next, invention concerning claim 9 computes the transform coefficient of two or more band components by carrying out band division of the picture signal recursively for a high-frequency component and a low-pass component by wavelet transform. Are a program for controlling the amount of signs of the compression image data compressed by carrying out entropy code modulation of this transform coefficient, and said each band component of said compression image data is received. While only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned From said band component which carried out the bit shift, it is characterized by operating a microprocessor as an image quality control section which chooses the candidate for coding according to target image quality.

[0027]

Invention concerning claim 10 is a program according to claim 9, and said image quality control section operates said microprocessor with using said priority carried out in weighting in consideration of human being's vision property.

[0028]

Invention concerning claim 11 is a program according to claim 9 or 10, and said image quality control section operates said microprocessor with determining said candidate for coding in said bit plane unit.

[0029]

Invention concerning claim 12 is a program given in any 1 term of claims 9-11, and said image quality control section operates said microprocessor with determining said candidate for coding per said coding pass.

[0030]

Next, invention concerning claim 13 computes the transform coefficient of two or more band components by carrying out band division of the picture signal recursively for a high-frequency component and a low-pass component by wavelet transform. Are a program for controlling the amount of signs of the compression image data compressed by carrying out entropy code modulation of this transform coefficient, and said each band component of said compression image data is received. While only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band

component concerned From the sign train which rearranged the coded data of said band component which carried out the bit shift in order of the predetermined scan, and generated it The cut-off point which suits the amount of target signs is computed, and it is characterized by operating a microprocessor as an amount control section of signs controlled to make said sign train before the cut-off point concerned output.

[0031]

invention concerning claim 14 -- a program according to claim 13 -- it is -- said amount control section of signs -- said coded data -- order with said high priority -- and said microprocessor is operated with rearranging in order of said scan turned to the low-pass side from the high region side in said same priority, and generating said sign train.

[0032]

Invention concerning claim 15 is a program given in any 1 term of claims 9-14, and receives said each band component of said compression image data. While only the number of bits corresponding to the priority set as said low-pass component according to the count by which band division was carried out recursively carries out the bit shift of the band component concerned Said

microprocessor is operated as a layer division control section controlled to divide into two or more layers said band component which carried out the bit shift.

[0033]

And invention concerning claim 16 is a program according to claim 15, and said layer division control section operates said microprocessor with using said priority carried out in weighting in consideration of human being's vision property.

[0034]

[Embodiment of the Invention]

Hereafter, the operation gestalt of this invention is explained.

[0035]

The configuration of the amount control unit of signs

Drawing 1 is the functional block diagram showing the outline configuration of the amount control device of signs concerning the operation gestalt of this invention. This amount control device 1 of signs (transformer coder) is equipped with read-out of data, MMU (memory management section)3 which controls write-out, the bit cut-off control section 4, the multiplexing section 5 and the priority table 6, and the layer division control section 7 to the mass store 2 and this store 2, and is constituted.

[0036]

In addition, all or a part of processing sections 4, 5, 6, and 7 which constitutes this amount control unit 1 of signs may consist of hardware, and it may consist of programs as which a microprocessor is operated.

[0037]

After MMU3 of this amount control device 1 of signs stores temporarily the input bit stream containing the compression coded data by which compression coding was carried out by JPEG2000 method at storage 2, according to the control signals CS1 and CS2 which control that amount of signs, it reads Data OD from storage 2, and outputs them to the multiplexing section 5. The multiplexing section 5 multiplexes Data OD and outputs them as an output bit stream.

[0038]

Drawing 2 is the functional block diagram showing the outline configuration of the bit cut-off control section 4 in the amount control device 1 of signs shown in drawing 1 . The bit cut-off control section 4 is equipped with the image quality control section 10 which chooses the candidate for coding according to target image quality, and the amount control section 11 of signs which controls the amount of signs according to the amount of target signs (the amount of the last

signs). Moreover, based on the DS information DS on the input bit stream supplied from MMU3, from the candidate for coding chosen by the image quality control section 10, the amount control section 11 of signs computes the cut-off point which suits the amount of target signs, generates the read-out control signal CS 1 to which the sign train before the cut-off point concerned is made to read, and supplies it to MMU3.

[0039]

Moreover, the layer division control section 7 shown in drawing 1 generates the read-out control signal CS 2 for making the output bit stream divided into two or more layers generate based on the DS information DS on the input bit stream supplied from MMU3, and outputs it to MMU3.

[0040]

And the priority table 6 stores the priority set as a low-pass component according to the count by which band division was carried out recursively according to JPEG2000 method to each band component of the compression coded data contained in an input bit stream, and supplies the priority data PS1 and PS2 to the bit cut-off control section 4 and the layer division control section 7.

[0041]

It explains in full detail below about the configuration and actuation of the amount control unit 1 of signs which have the above configuration.

[0042]

Priority setting processing (the 1st example)

The 1st example of the setting approach of the priority recorded on the above-mentioned priority table 6 is explained. In this invention, a priority is determined as a low-pass component to each band component (subband) according to the count by which band division was carried out recursively. In this example, the priority of "+(n-1) 1" and the band component LLn is determined [the priority of the band component HHn in the decomposition level n (n:1 or more integers)] for the priority of "n-1" and the band components HLn and LHn as "+(n-1) 2", respectively. For example, the priority of "0" and the band component LL 3 is set as "4" for the priority of the band component HH1 shown in drawing 24 . Drawing 3 is the mimetic diagram showing the two-dimensional image 25 which carried out band division according to the octave division method. It is given to each band component any of a priority "0", "1", "2", "3", and "4" they are.

[0043]

The information on the priority corresponding to each of the band components HHn, HLn, LHn, and LLn is recorded on the priority table 6, and the image quality control section 10, the amount control section 11 of signs, and the layer division control section 7 set a priority to it to each band component according to the priority data PS1 and PS2 acquired from this priority table 6. It is that only the number of bits corresponding to a priority specifically shifts the transform coefficient (it is only hereafter called a "transform coefficient".) by which entropy code modulation was carried out in each band component, and a priority is set up to each transform coefficient. In addition, in this bit shift processing, there is no need of actually performing a bit shift operation to each transform coefficient, and it should just not necessarily shift the location of each bit of a transform coefficient virtually. In this case, the location of the bit plane with which each bit of a transform coefficient belongs does not change.

[0044]

Drawing 4 is drawing for explaining the priority setting processing by the bit shift. In the example shown in drawing 3 , since the priority of the band component LL 3 is "4", it acts as the 4-bit left shift of the corresponding transform coefficient 26. Moreover, it acts as the triplet left shift of the transform coefficients 26 and 26 of

the band components HL3 and LH3 which had the priority "3" set up, and it acts as the 2-bit left shift of the transform coefficients 26, 26, and 26 of the band components HH3, HL2, and LH2 which had the priority "2" set up, and acts as the 1-bit left shift of the transform coefficients 26, 26, and 26 of the band components HH2, HL1, and LH1 which had the priority "1" set up. At this time, as shown in drawing 5 , the transform coefficient of two-dimensional image 25A in front of a bit shift changes to the transform coefficient shown by two-dimensional image 25B by the above-mentioned left bit shift processing. For example, the transform coefficient value (= 4) of the band component LL 3 is changed into 4x24=64 by the 4-bit left shift.

[0045]

Next, the reason (theoretical background) for setting up a priority as mentioned above is explained below.

[0046]

Optimization processing using distorted measure was performed by the approach of conventional rate and distortion optimization (R-D optimization) mentioned above. According to said bibliography A by David S.Taubman and others, the distorted measure Di (z) is computed according to a degree type (1).

[0047]

[Equation 1]

$$D_i^{(z)} = G_{b[i]} \sum_j \left(oy_i^{K[i,j]}[j] - y_i[j]\right)^2 \quad \cdots (1)$$

$$\text{但し、} \quad K[i,j] = p_i^{(z)}[j]$$

[0048]

z among an upper type (1) bit cut-off point (bit truncation point);oyiK [i, j] and [j] The j-th sampled value of the code block reverse-quantized with the bit plane of eye K [i, j] watch (multiplier value); yi [j] The j-th sampled value of the code block concerned (multiplier value); Gb [i] is square of the norm of the synthetic filter coefficient corresponding to subband b [i], and shows the weighting factor of the distorted model depending on the subband b concerned. In addition, the notation of the notation shown in the upper type (1) for convenience of explanation differs from it in said bibliography A a little.

[0049]

In a rate and distortion optimization, optimization processing which makes min the amount of total in subband [of this distorted measure Di (z)] b [i] is performed. The weighting factor Gb of the subband b expresses weighting for reducing distortion of an image.

[0050]

The weighting factor Gb of the subband b is computed according to a degree type (2).

[0051]

[Equation 2]

$$G_b = \| S_b \|^2 \quad (但し、\quad S_b = s_b[n]) \quad \cdots (2)$$

[0052]

Here, sb [n] shows the 1-dimensional composition filter factor of the subband b among the upper type (2). Moreover, notation ||x|| shows the norm about Vector x.

[0053]

According to the formula (4.39) indicated by said bibliography A and (4.40), the 1-dimensional composition filter coefficient sL of the low-pass component L1 in decomposition level 1 [1], [n], and the 1-dimensional composition filter factor sH of the high-frequency component H1 in isomerism solution level [1] and [n] are computed according to a degree type (3).

[0054]

[Equation 3]

$$\begin{cases} s_{L[1]}[n] = g_0[n] \\ s_{H[1]}[n] = g_1[n] \end{cases} \quad \cdots (3)$$

[0055]

Here, the low pass filter multiplier of the rectification filter with which g0 [n] carries out band division of the picture signal, and g1 [n] show the high-pass filter multiplier among the upper type (3), respectively.

[0056]

Moreover, the 1-dimensional composition filter coefficient sL [d] of the low-pass component Ld in the decomposition level d (d= 1, 2, --, D), [n], and the 1-dimensional composition filter factor sH of the high-frequency component Hd in isomerism solution level [d] and [n] are computed according to a degree type (4).

[0057]

[Equation 4]

$$\begin{cases} s_{L[d]}[n] = \sum_k s_{L[d-1]}[k]\, g_0[n-2k] \\ s_{H[d]}[n] = \sum_k s_{H[d-1]}[k]\, g_0[n-2k] \end{cases} \quad \cdots (4)$$

[0058]

And the square of the norm of the 1-dimensional composition filter factor of the low-pass component Ld in the decomposition level d is computed according to a degree type (5).

[0059]

[Equation 5]

$$G_{L[d]} = \| s_{L[d]}[n] \|^2 = \sum_j \left| s_{L[d]}[j] \right|^2 \quad \cdots (5)$$

[0060]

The square of the norm of the 1-dimensional composition filter factor of a high-frequency component as well as an upper type (5) is computable.

[0061]

Next, the two-dimensional composition filter factor of the band components LLD, HLd, LHd, and HHd in the decomposition level d (d= 1, 2, --, D;D integer) can be expressed by the product of the above-mentioned 1-dimensional composition filter factor, and can also express the two-dimensional weighting factor Gb of the band component b by the with a 1-dimensional weighting factor product. Specifically, a two-dimensional composition filter factor and a two-dimensional weighting factor are computed according to a degree type (6).

[0062]

[Equation 6]

$$\begin{cases} s_{LL[D]}[n_1, n_2] = s_{L[D]}[n_1] s_{L[D]}[n_2] \Rightarrow G_{LL[D]} = G_{L[D]} \cdot G_{L[D]} \\ s_{HL[d]}[n_1, n_2] = s_{L[d]}[n_1] s_{H[d]}[n_2] \Rightarrow G_{HL[d]} = G_{L[d]} \cdot G_{H[d]} \\ s_{LH[d]}[n_1, n_2] = s_{H[d]}[n_1] s_{L[d]}[n_2] \Rightarrow G_{LH[d]} = G_{H[d]} \cdot G_{L[d]} \\ s_{HH[d]}[n_1, n_2] = s_{H[d]}[n_1] s_{H[d]}[n_2] \Rightarrow G_{HH[d]} = G_{H[d]} \cdot G_{H[d]} \end{cases} \cdots (6)$$

[0063]

Among the upper type (6), Subscript LL [D] shows the subband LLD, and HL [d], LH [d], and HH [d] express the subbands HLd, LHd, and HHd, respectively.

[0064]

The square root of a weighting factor Gb is a norm. The count result about the two-dimensional weighting factor Gb is shown in following Table 1 - 4. The numeric value of the norm corresponding to Table 1 for the numeric value of the square of the norm of each band component of a filter (9 7) (filter of 9x7 taps) is shown in Table 1 in Table 2, respectively. Moreover, the numeric value of the norm corresponding to Table 3 for the numeric value of the square of the norm of

each band component of a filter (5 3) (filter of 5x3 taps) is shown in Table 3 in Table 4, respectively.

[0065]

[Table 1]

(9,7)フィルタの歪の重み係数G（ノルムの二乗）

分解レベル	LL	HL	LH	HH
1	3.86479	1.02270	1.02270	0.27063
2	16.99426	3.98726	3.98726	0.93551
3	70.84158	17.50056	17.50056	4.32330
4	286.81360	72.83113	72.83113	18.49415
5	1150.90066	294.69647	294.69647	75.45917
6	4607.30956	1182.34209	1182.34209	303.41630
7	18432.96262	4732.98083	4732.98083	1215.27440
8	73735.57967	18935.55202	18935.55202	4862.71528
9	294946.04918	75745.84127	75745.84127	19452.48118
10	1179787.92756	302986.99951	302986.99951	77811.54539
11	4719155.44117	1211951.63280	1211951.63280	311247.80240

[0066]

[Table 2]

(9,7)フィルタのノルム

分解レベル	LL	HL	LH	HH
1	1.96591	1.01129	1.01129	0.52022
2	4.12241	1.99681	1.99681	0.96722
3	8.41674	4.18337	4.18337	2.07926
4	16.93557	8.53412	8.53412	4.30048
5	33.92493	17.16673	17.16673	8.68672
6	67.87717	34.38520	34.38520	17.41885
7	135.76805	68.79666	68.79666	34.86079
8	271.54296	137.60651	137.60651	69.73317
9	543.08936	275.21962	275.21962	139.47215
10	1086.18043	550.44255	550.44255	278.94721
11	2172.36172	1100.88675	1100.88675	557.89587

[0067]

[Table 3]

(5,3)フィルタの歪の重み係数G（ノルムの二乗）

分解レベル	LL	HL	LH	HH
1	2.25000	1.07813	1.07813	0.51660
2	7.56250	2.53516	2.53516	0.84985
3	28.89063	8.52441	8.52441	2.51520
4	114.22266	32.52173	32.52173	9.25966
5	455.55566	128.52106	128.52106	36.25827
6	1820.88892	512.52089	512.52089	144.25793
7	7282.22223	2048.52085	2048.52085	576.25784
8	29127.55556	8192.52084	8192.52084	2304.25782
9	116508.88889	32768.52083	32768.52083	9216.25781
10	466034.22222	131072.52083	131072.52083	36864.25781
11	1864135.55556	524288.52083	524288.52083	147456.25781

[0068]

[Table 4]

(5,3)フィルタのノルム

分解レベル	LL	HL	LH	HH
1	1.50000	1.03833	1.03833	0.71875
2	2.75000	1.59222	1.59222	0.92188
3	5.37500	2.91966	2.91966	1.58594
4	10.68750	5.70278	5.70278	3.04297
5	21.34375	11.33671	11.33671	6.02148
6	42.67188	22.63892	22.63892	12.01074
7	85.33594	45.26059	45.26059	24.00537
8	170.66797	90.51255	90.51255	48.00269
9	341.33398	181.02077	181.02077	96.00134
10	682.66699	362.03939	362.03939	192.00067
11	1365.33350	724.07770	724.07770	384.00034

[0069]

Furthermore, when the norm of the low-pass component LL 1 in decomposition level 1 is expressed with alpha, a value as shown in drawing 6 about each band component is set up using this norm alpha. The two-dimensional image 27 shown in drawing 6 is drawing showing the two-dimensional image 120 by which band division was carried out according to the octave division method. The set point of "2n-2xalpha" and the band component LLn is set [the set point of the

band component HHn in the decomposition level n (n:1 or more integers)] as "2n-1xalpha" for the set point of "2n-3xalpha" and the band components HLn and LHn, respectively. It follows, for example, the set point of the band component LH 1 is set as "2-1xalpha."

[0070]

If the above-mentioned set point is compared with the numeric value of a norm shown in Table 2 and Table 4, both approximate in general. In the case of Table 2 (alpha= 1.96591), for example, "the set point (corresponding band component)" of each band component shown in drawing 6 It is set to about 0.49 (HH1), about 0.98 (HL1, LH1), about 1.96 (HL2, LH2, HH3), about 3.93 (HL3, LH3), and about 7.86 (LL3), and it turns out that these set points are approximated with the numeric value of a norm shown in Table 2.

[0071]

Moreover, in drawing 6 , the norm of the band component LL 1 is cajoled in alpha= 2, and it turns out that the characteristic of the value which acted as the 1-bit left shift of the set point of each band component, i.e., the exponentiation value of 2 which carried out the multiplication of 21 to all the set points, is in agreement with the value of the priority shown in drawing 3 . Therefore, it is

equal to carrying out the multiplication of the norm (square root of a weighting factor) of the filter used by the rate and distortion optimization to the sampled value (transform coefficient value) of each band component in approximation to set a priority as each band component like the 1st example. Therefore, the priority of this example is set up so that distortion of an image may be reduced.

[0072]

Priority setting processing (the 2nd example)

Next, the 2nd example of the priority setting approach is explained. In this example, the value which did the division of the norm which is the square root of the above-mentioned weighting factor Gb of each band component by the norm of the minimum region component LL in the highest decomposition level is cajoled in the exponentiation value of 2, and the absolute value of the characteristic of the exponentiation value of 2 is set up as a priority. The norm of the minimum region component LLn of the concrete highest decomposition level n is set to alpha. When set the norm of other band components to x, the function about the variable y cajoled in the exponentiation of 2 is set to R [y], the function which computes the characteristic m of 2m of exponentiation of 2 of Variable y is made into m=l [2m] and the absolute value about Variable y is made into |y|, A

priority p is computed according to p=|I[R[x/alpha]] |.

[0073]

The priority computed using the norm of the filter (9 7) shown in the above-mentioned table 2 is shown in following Table 5. the decomposition level highest here -- 5 -- it is -- alpha= 33.92493 -- it comes out. Moreover, the band division Fig. showing the two-dimensional image 28 which described the priority shown in Table 5 in drawing 7 is shown. In addition, "x" of front Naka means that the priority of the band component concerned is not calculated.

[0074]

[Table 5]

(9,7)フィルタの優先度

分解レベル	LL	HL	LH	HH
1	×	5	5	6
2	×	4	4	5
3	×	3	3	4
4	×	2	2	3
5	0	1	1	2

[0075]

Moreover, the priority computed using the norm of the filter (5 3) shown in the above-mentioned table 4 is shown in the following table 6.

[0076]

[Table 6]

(5,3)フィルタの優先度

分解レベル	LL	HL	LH	HH
1	×	4	4	5
2	×	4	4	5
3	×	3	3	4
4	×	2	2	3
5	0	1	1	2

[0077]

Although only the number of bits of a priority acted as the left shift of the transform coefficient of each band component and the priority was set up in the 1st example of the above, processing to which only the number of bits of a priority carries out the right shift of the transform coefficient of each band

component is performed in the **** 2 example. However, right bit shift processing is performed so that the bit length of a transform coefficient may be made to expand. Drawing 8 is the transform coefficients 29 and 29 of the band component to which the right shift only of the number of bits of the priority shown in drawing 7 was carried out, and the mimetic diagram showing --.

[0078]

Priority setting processing (the 3rd example)

Next, the priority setting approach concerning the 3rd example in consideration of human being's vision property is explained. Although the image quality of a decode image is good in object evaluation when the priority shown in the 2nd example of the above about the image with a high resolution of about millions of pixels is applied, it is not necessarily good in vision evaluation of human being. Then, the priority carried out in weighting in consideration of human being's vision property is used for the priority setting approach of this example. It enables this to generate the compression image of high display image quality.

[0079]

The weighting MSE (Weighted Mean Squared Error;WMSE) based on CSF (human visual system Contrast Sensitivity Function) is indicated by Chapter 16

of said bibliography A. According to this publication, in order to improve vision evaluation of human being, it is desirable to correct an upper type (1) to a degree type (7).

[0080]

[Equation 7]

$$D_i^{(z)} = W_{b[i]}^{csf} G_{b[i]} \sum_j \left(oy_i^{K[i,j]}[j] - y_i[j] \right)^2 \quad \cdots (7)$$

[0081]

Here Wb[i] csf among an upper type (7) It is called "energy weighting factor" of subband b [i]. The recommendation numeric value of Wb[i] csf "ISO/IEC JTC 1/SC 29/WG1 (ITU-T SG8) N2406 and "JPEG 2000 Part 1 FDIS (includes COR 1, COR 2, and DCOR3), Reference of "4 December 2001" (it is hereafter called Bibliography B.) It is indicated. The numeric value of "energy weighting factor" indicated by drawing 9 - drawing 11 at Bibliography B is shown.

[0082]

"level" in drawing 9 - drawing 11 -- and -- "Lev" shows decomposition level, "Comp" shows the brightness component Y and the color difference components Cb and Cr, respectively, and the example of 1000, 1700, 2000, 3000, and 4000 is shown for "Viewing distance (sight)." Moreover, "Viewing distance 1000", "Viewing distance 1700", "Viewing distance 2000", "Viewing distance 3000", and "Viewing distance 4000" mean the sight when leaving 10 inches of the displays or printed matter of 100dpi, 170dpi, 200dpi, 300dpi, and 400dpi, and seeing it, respectively.

[0083]

The square roots (Wb[i] csf-Gb [i]) 1/2 of the weighting multiplier of an upper type (7) were calculated using the numeric value shown in drawing 9 - drawing 11 . The count result is shown in following Table 7 - 18. Table 7 - 9 the numeric value for black and white of the filter (9 7) calculated using the numeric value shown in drawing 9 , and Table 10 - 12 The numeric value for colors of the filter (9 7) calculated using the numeric value shown in drawing 10 and drawing 11 Table 13 - 15 The numeric value for colors of the filter (5 3) calculated using the numeric value Table 16 - 18 indicates the numeric value for black and white of the filter (5 3) calculated using the numeric value shown in drawing 9 to be to

drawing 10 and drawing 11 is shown, respectively.

[0084]

[Table 7]

(9,7)フィルタの白黒用数値

	Viewing distance 1000			
分解レベル	LL	HL	LH	HH
1	X	0.567135	0.567135	0.147832
2	X	1.996812	1.996812	0.703332
3	X	4.183367	4.183367	2.079256
4	X	8.534116	8.534116	4.300482
5	33.92493	17.16673	17.16673	8.686724

[0085]

[Table 8]

(9,7)フィルタの白黒用数値

	Viewing distance 2000			
分解レベル	LL	HL	LH	HH
1	X	0.180509	0.180509	0.022698
2	X	1.119894	1.119894	0.274876
3	X	4.183367	4.183367	1.512041
4	X	8.534116	8.534116	4.300482
5	33.92493	17.16673	17.16673	8.686724

[0086]

[Table 9]

(9,7)フィルタの白黒用数値

	Viewing distance 4000			
分解レベル	LL	HL	LH	HH
1	X	0.014941	0.014941	0.000298
2	X	0.358645	0.358645	0.042464
3	X	2.360858	2.360858	0.594601
4	X	8.534116	8.534116	3.146525
5	33.92493	17.16673	17.16673	8.686724

[0087]

[Table 10]

(9,7)フィルタのカラー用数値

		Viewing distance 1000			
	分解レベル	LL	HL	LH	HH
Y	1	X	0.76489	0.76489	0.298115
	2	X	1.99337	1.99337	0.963884
	3	X	4.183367	4.183367	2.079256
	4	X	8.534116	8.534116	4.300482
	5	33.92493	17.16673	17.16673	8.686724
	分解レベル	LL	HL	LH	HH
Cb	1	X	0.233105	0.233105	0.059194
	2	X	0.900041	0.900041	0.299041
	3	X	2.721205	2.721205	1.10554
	4	X	6.77171	6.77171	3.063212
	5	33.92493	15.16158	15.16158	7.241097
	分解レベル	LL	HL	LH	HH
Cr	1	X	0.33996	0.33996	0.104307
	2	X	1.10404	1.10404	0.405203
	3	X	3.03569	3.03569	1.299749
	4	X	7.177464	7.177464	3.337948
	5	33.92493	15.63678	15.63678	7.578107

[0088]

[Table 11]

(9,7)フィルタのカラー用数値

		Viewing distance 1700			
	分解レベル	LL	HL	LH	HH
Y	1	X	0.310658	0.310658	0.056662
	2	X	1.72044	1.72044	0.718005
	3	X	4.183367	4.183367	2.079256
	4	X	8.534116	8.534116	4.300482
	5	33.92493	17.16673	17.16673	8.686724
	分解レベル	LL	HL	LH	HH
Cb	1	X	0.09892	0.09892	0.01622
	2	X	0.559243	0.559243	0.147297
	3	X	2.098595	2.098595	0.753271
	4	X	5.883453	5.883453	2.490925
	5	33.92493	14.05553	14.05553	6.47921
	分解レベル	LL	HL	LH	HH
Cr	1	X	0.179438	0.179438	0.040124
	2	X	0.775746	0.775746	0.240417
	3	X	2.5039	2.5039	0.979107
	4	X	6.465668	6.465668	2.86391
	5	33.92493	14.77858	14.77858	6.976933

[0089]

[Table 12]

(9,7)フィルタのカラー用数値

		Viewing distance 3000			
	分解レベル	LL	HL	LH	HH
Y	1	X	0.038921	0.038921	0.0016
	2	X	0.819947	0.819947	0.176768
	3	X	3.85307	3.85307	1.763882
	4	X	8.534116	8.534116	4.300482
	5	33.92493	17.16673	17.16673	8.686724
	分解レベル	LL	HL	LH	HH
Cb	1	X	0.023571	0.023571	0.001776
	2	X	0.247647	0.247647	0.043245
	3	X	1.337728	1.337728	0.385929
	4	X	4.603618	4.603618	1.734612
	5	33.92493	12.31002	12.31002	5.331711
	分解レベル	LL	HL	LH	HH
Cr	1	X	0.060957	0.060957	0.007791
	2	X	0.423067	0.423067	0.097358
	3	X	1.793238	1.793238	0.597979
	4	X	5.39042	5.39042	2.192081
	5	33.92493	13.39161	13.39161	6.038385

[0090]

[Table 13]

(5,3)フィルタの白黒用数値

	Viewing distance 1000			
分解レベル	LL	HL	LH	HH
1	X	0.5823	0.5823	0.204249
2	X	1.592217	1.592217	0.670362
3	X	2.91966	2.91966	1.585938
4	X	5.702783	5.702783	3.042969
5	21.34375	11.33671	11.33671	6.021484

[0091]

[Table 14]

(5,3)フィルタの白黒用数値

	Viewing distance 2000			
分解レベル	LL	HL	LH	HH
1	X	0.185335	0.185335	0.03136
2	X	0.892981	0.892981	0.26199
3	X	2.91966	2.91966	1.153299
4	X	5.702783	5.702783	3.042969
5	21.34375	11.33671	11.33671	6.021484

[0092]

[Table 15]

(5,3)フィルタの白黒用数値

	Viewing distance 4000			
分解レベル	LL	HL	LH	HH
1	X	0.01534	0.01534	0.000412
2	X	0.285977	0.285977	0.040473
3	X	1.647693	1.647693	0.453527
4	X	5.702783	5.702783	2.226443
5	21.34375	11.33671	11.33671	6.021484

[0093]

[Table 16]

(5,3) フィルタのカラー用数値

		Viewing distance 1000			
	分解レベル	LL	HL	LH	HH
Y	1	X	0.785342	0.785342	0.411885
	2	X	1.589472	1.589472	0.918699
	3	X	2.91966	2.91966	1.585938
	4	X	5.702783	5.702783	3.042969
	5	21.34375	11.33671	11.33671	6.021484
	分解レベル	LL	HL	LH	HH
Cb	1	X	0.239338	0.239338	0.081784
	2	X	0.717674	0.717674	0.285023
	3	X	1.899186	1.899186	0.843243
	4	X	4.525084	4.525084	2.167491
	5	21.34375	10.01254	10.01254	5.019401
	分解レベル	LL	HL	LH	HH
Cr	1	X	0.349051	0.349051	0.144114
	2	X	0.880339	0.880339	0.386208
	3	X	2.118672	2.118672	0.991374
	4	X	4.796223	4.796223	2.361891
	5	21.34375	10.32635	10.32635	5.25301

[0094]

[Table 17]

(5,3)フィルタのカラー用数値

		Viewing distance 1700			
	分解レベル	LL	HL	LH	HH
Y	1	X	0.318965	0.318965	0.078286
	2	X	1.371843	1.371843	0.684347
	3	X	2.91966	2.91966	1.585938
	4	X	5.702783	5.702783	3.042969
	5	21.34375	11.33671	11.33671	6.021484
	分解レベル	LL	HL	LH	HH
Cb	1	X	0.101565	0.101565	0.02241
	2	X	0.445929	0.445929	0.140392
	3	X	1.464653	1.464653	0.574552
	4	X	3.931521	3.931521	1.762548
	5	21.34375	9.282115	9.282115	4.491275
	分解レベル	LL	HL	LH	HH
Cr	1	X	0.184236	0.184236	0.055437
	2	X	0.618564	0.618564	0.229147
	3	X	1.747524	1.747524	0.746807
	4	X	4.320576	4.320576	2.026468
	5	21.34375	9.759606	9.759606	4.836288

[0095]

[Table 18]

(5,3)フィルタのカラー用数値

	分解レベル	Viewing distance 3000			
	分解レベル	LL	HL	LH	HH
Y	1	X	0.039962	0.039962	0.00221
	2	X	0.653809	0.653809	0.168482
	3	X	2.689138	2.689138	1.345389
	4	X	5.702783	5.702783	3.042969
	5	21.34375	11.33671	11.33671	6.021484
	分解レベル	LL	HL	LH	HH
Cb	1	X	0.024201	0.024201	0.002453
	2	X	0.197468	0.197468	0.041218
	3	X	0.933628	0.933628	0.294364
	4	X	3.076292	3.076292	1.227391
	5	21.34375	8.129398	8.129398	3.695849
	分解レベル	LL	HL	LH	HH
Cr	1	X	0.062587	0.062587	0.010765
	2	X	0.337345	0.337345	0.092794
	3	X	1.251539	1.251539	0.456105
	4	X	3.60206	3.60206	1.551089
	5	21.34375	8.843668	8.843668	4.185702

[0096]

Next, the priority of each band component was computed in the same procedure using the numeric value shown in above-mentioned Table 7 - 18 as the 2nd

example of the above described. Namely, the numeric value of the minimum region component LLn of the highest decomposition level n is set to alpha. When set the numeric value of other band components to x, the function about the variable y cajoled in the exponentiation of 2 is set to R [y], the function which computes the characteristic m of 2m of exponentiation of 2 of Variable y is made into m=I [2m] and the absolute value about Variable y is made into |y|, A priority p is computed according to p=|I[R[x/alpha]] |.

[0097]

The value of a priority is shown in following Table 19 - 30. Table 19, table 20, Table 21, Table 22, Table 23, Table 24, Table 25, Table 26, Table 27, Table 28, Table 29, and the priority of table 30 are computed using the numeric value of the above-mentioned table 7, Table 8, Table 9, Table 10, Table 11, Table 12, Table 13, Table 14, Table 15, and Table 16, 17, and 18, respectively.

[0098]

[Table 19]

(9,7)フィルタの白黒用優先度テーブル

	Viewing distance 1000			
分解レベル	LL	HL	LH	HH
1	X	6	6	8
2	X	4	4	6
3	X	3	3	4
4	X	2	2	3
5	0	1	1	2

[0099]

[Table 20]

(9,7)フィルタの白黒用優先度テーブル

	Viewing distance 2000			
分解レベル	LL	HL	LH	HH
1	X	8	8	11
2	X	5	5	7
3	X	3	3	5
4	X	2	2	3
5	0	1	1	2

[0100]

[Table 21]

(9,7)フィルタの白黒用優先度テーブル

	Viewing distance 4000			
分解レベル	LL	HL	LH	HH
1	X	11	11	17
2	X	7	7	10
3	X	4	4	6
4	X	2	2	4
5	0	1	1	2

[0101]

[Table 22]

(9,7)フィルタのカラー用優先度テーブル

		Viewing distance 1000			
	分解レベル	LL	HL	LH	HH
Y	1	X	6	6	7
	2	X	4	4	5
	3	X	3	3	4
	4	X	2	2	3
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cb	1	X	7	7	9
	2	X	5	5	7
	3	X	4	4	5
	4	X	2	2	4
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cr	1	X	7	7	8
	2	X	5	5	6
	3	X	4	4	5
	4	X	2	2	3
	5	0	1	1	2

[0102]

[Table 23]

(9,7)フィルタのカラー用優先度テーブル

		Viewing distance 1700			
	分解レベル	LL	HL	LH	HH
Y	1	X	7	7	9
	2	X	4	4	6
	3	X	3	3	4
	4	X	2	2	3
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cb	1	X	9	9	11
	2	X	6	6	8
	3	X	4	4	6
	4	X	3	3	4
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cr	1	X	8	8	10
	2	X	6	6	7
	3	X	4	4	5
	4	X	2	2	4
	5	0	1	1	2

[0103]

[Table 24]

(9,7)フィルタのカラー用優先度テーブル

		Viewing distance 3000			
	分解レベル	LL	HL	LH	HH
Y	1	X	10	10	14
	2	X	5	5	8
	3	X	3	3	4
	4	X	2	2	3
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cb	1	X	11	11	14
	2	X	7	7	10
	3	X	5	5	7
	4	X	3	3	4
	5	0	2	2	3
	分解レベル	LL	HL	LH	HH
Cr	1	X	9	9	12
	2	X	6	6	9
	3	X	4	4	6
	4	X	3	3	4
	5	0	1	1	3

[0104]

[Table 25]

(5,3)フィルタの白黒用優先度テーブル

	Viewing distance 1000			
分解レベル	LL	HL	LH	HH
1	X	5	5	7
2	X	4	4	5
3	X	3	3	4
4	X	2	2	3
5	0	1	1	2

[0105]

[Table 26]

(5,3)フィルタの白黒用優先度テーブル

	Viewing distance 2000			
分解レベル	LL	HL	LH	HH
1	X	7	7	9
2	X	5	5	6
3	X	3	3	4
4	X	2	2	3
5	0	1	1	2

[0106]

[Table 27]

(5,3)フィルタの白黒用優先度テーブル

	Viewing distance 4000			
分解レベル	LL	HL	LH	HH
1	X	11	11	16
2	X	6	6	9
3	X	4	4	6
4	X	2	2	3
5	0	1	1	2

[0107]

[Table 28]

(5,3)フィルタのカラー用優先度テーブル

		Viewing distance 1000			
	分解レベル	LL	HL	LH	HH
Y	1	X	5	5	6
	2	X	4	4	5
	3	X	3	3	4
	4	X	2	2	3
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cb	1	X	7	7	8
	2	X	5	5	6
	3	X	4	4	5
	4	X	2	2	3
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cr	1	X	6	6	7
	2	X	5	5	6
	3	X	3	3	5
	4	X	2	2	3
	5	0	1	1	2

[0108]

[Table 29]

(5,3)フィルタのカラー用優先度テーブル

		Viewing distance 1700			
	分解レベル	LL	HL	LH	HH
Y	1	X	6	6	8
	2	X	4	4	5
	3	X	3	3	4
	4	X	2	2	3
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cb	1	X	8	8	10
	2	X	6	6	7
	3	X	4	4	5
	4	X	3	3	4
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cr	1	X	7	7	9
	2	X	5	5	7
	3	X	4	4	5
	4	X	2	2	3
	5	0	1	1	2

[0109]

[Table 30]

(5,3)フィルタのカラー用優先度テーブル

	分解レベル	Viewing distance 3000 LL	HL	LH	HH
Y	1	X	9	9	13
	2	X	5	5	7
	3	X	3	3	4
	4	X	2	2	3
	5	0	1	1	2
	分解レベル	LL	HL	LH	HH
Cb	1	X	10	10	13
	2	X	7	7	9
	3	X	5	5	6
	4	X	3	3	4
	5	0	1	1	3
	分解レベル	LL	HL	LH	HH
Cr	1	X	8	8	11
	2	X	6	6	8
	3	X	4	4	6
	4	X	3	3	4
	5	0	1	1	2

[0110]

At this example, a priority is set up to the transform coefficient of each band component like the 2nd example of the above by carrying out the right shift only

of the number of bits of the priority shown in above Table 19 - 30. Thereby, the priority in consideration of human being's vision property can be set up.

[0111]

Image quality control processing

Next, the configuration and the contents of processing of the image quality control section 10 which were shown in drawing 2 are explained. Drawing 12 is the functional block diagram showing the outline configuration of this image quality control section 10.

[0112]

This image quality control section 10 is equipped with the image quality parameter selection section 31 which chooses and outputs the image quality parameter QP which was suitable for the target image quality concerned from two or more image quality parameter groups, and the judgment section 30 for coding which determines the candidate for coding based on target image quality (high definition, standard image quality, low image quality, etc.). The judgment section 30 for coding sets up an above-mentioned priority to each band component of the compression image data contained in an input bit stream according to the priority data PS 1 acquired from the priority table 6. Moreover,

the judgment section 30 for coding determines the candidate for coding according to the target image quality specified with said image quality parameter QP according to the set-up priority, and carries out the generation output of the scan field information SA.

[0113]

Hereafter, the decision approach for [in the judgment section 30 for coding] coding is explained. Drawing 13 is the transform coefficients 33 and 33 by which the bit shift was carried out according to the priority, and a mimetic diagram which illustrates --. According to the priority, the bit shift of each transform coefficient 33 is carried out. Moreover, the numbers 0, 1, --, 10 given to each bit of a transform coefficient 33 show the number of the bit plane with which the bit concerned belongs. here -- LSB number =0 and MSB number =10 -- it comes out.

[0114]

The judgment section 30 for coding sets up coding termination Rhine 32 according to the image quality parameter QP, and it determines a high order bit as the candidate for coding rather than coding termination Rhine 32 concerned, and it generates the scan field information SA so that a lower bit may be

removed for coding rather than the Rhine 32. It enables this to sort out the candidate for coding efficiently. Consequently, in each code block, the amount control section 11 of signs which received the scan field information SA will scan only the bit plane of a high order rather than coding termination Rhine 32, and will omit a low-ranking bit plane rather than that Rhine 32.

[0115]

The judgment section 30 for coding can determine the candidate for coding per coding pass further according to the image quality parameter QP. The image quality parameter QP contains the parameter group which shows a limit of the bit plane for coding, and a limit of the coding pass for coding (CL pass, SIG pass, and MR pass). The image quality parameter QP suitable for the image which has the resolution of 2048x2560 pixels in following Table 31 is illustrated. In addition, since it is necessary to make resolution of the subband of the minimum region smaller than 128x128 pixels, five or more decomposition level is required.

[0116]

[Table 31]

画質パラメータの例

	優先度の制限		符号化効率の制限
帯域成分	ビットプレーン数	パス名	最大パス数
LL5	0	CL	17
LH5	0	CL	17
HL5	0	CL	17
HH5	0	CL	17
LH4	0	CL	17
HL4	0	CL	17
HH4	1	MR	14
LH3	1	MR	14
HL3	1	MR	14
HH3	2	SIG	14
HL2	2	SIG	14
LH2	2	SIG	14
HH2	3	SIG	14
LH1	3	SIG	14
HL1	3	SIG	14
HH1	4	CL	14

CL:Cleanup pass
MR:Magnitude Refinement pass
SIG:Significant propagation pass

[0117]

In Table 31, rather than coding termination Rhine 32 which showed "the number

of bit planes" to drawing 13 , a "pathname" expresses the last coding pass of the inside for coding, and the "maximum numbers of passes" expresses the upper limit of the coding numbers of passes for coding for the number of the bit planes for [of a lower bit] a cut-off, respectively.

[0118]

The example of processing at the time of applying drawing 13 and Table 31 is explained below. To drawing 14 , "000110101112= 21510" is illustrated as a transform coefficient 33 of the band component LL 5 (Y2 shall express binary-value Y and X10 shall express the decimal value X). CL pass and the maximum numbers of passes are restricted for the last coding pass in the band component LL 5 to 17 as shown in Table 31.

[0119]

The context judging is made so that the 7th bit of the transform coefficient shown in drawing 14 may belong to SIG pass or CL pass. When it belongs to the bit plane which consists of only 0 bit, it encodes by the method called a tag tree (Tag tree), and the 8th - the 10th high order bit is encoded with SIG pass or CL pass, when coding pass has already begun. When the 7th bit belongs to coding initiation pass (CL pass), the context judging of the lower bit containing the 6th

bit is carried out so that it may belong to MR pass. Generally, the low-ranking bit plane is encoded in order of SIG pass, MR pass, and CL pass from a viewpoint of coding effectiveness rather than the bit plane of coding initiation. Therefore, since the maximum numbers of passes are restricted to 17, a total of 17 pass from CL pass of the 7th bit to the SIG pass of the 1st bit becomes a candidate for coding. However, since the 1st bit belongs to MR pass, it does not go into the candidate for coding. Therefore, 2 bits of low order are omitted and the value after a cut-off is set to "000110101002= 21210." It will be set to "000110101102= 21410" if this value is reverse-quantized on the mid point.

[0120]

Next, "000000011112= 1510" is illustrated as a transform coefficient 33 of the band component LL 5 to drawing 15 . The 3rd bit of a transform coefficient belongs to SIG pass or CL pass. When it belongs to the bit plane which consists of only 0 bit, it encodes by the tag tree (Tag tree), and the 4th - the 10th high order bit is encoded with SIG pass or CL pass, when coding pass has already begun. When the 3rd bit belongs to coding initiation pass (CL pass), the lower bit containing the 2nd bit belongs to MR pass, and a total of ten pass to CL pass of the 0th bit becomes a candidate for coding from CL pass of the 3rd bit. The value

after a cut-off will be set to "000000011112= 1510", if it is set to "000000011112= 1510" and this value is reverse-quantized.

[0121]

Next, "000010111112= 9510" is illustrated as a transform coefficient 33 of the band component HH2 to drawing 16 . SIG pass and the maximum numbers of passes are restricted for the last coding pass in the band component HH2 to 14 as shown in Table 31. Moreover, the bit plane of a low order triplet is omitted.

[0122]

The 6th bit of a transform coefficient belongs to SIG pass or CL pass. When it belongs to the bit plane which consists of only 0 bit, it encodes by the tag tree (Tag tree), and the 7th - the 10th high order bit is encoded with SIG pass or CL pass, when coding pass has already begun. When the 6th bit belongs to coding initiation pass (CL pass), the lower bit containing the 5th bit belongs to MR pass. Moreover, although eight pass from CL pass of the 6th bit to the SIG pass of the 4th bit becomes a candidate for coding for limit that even the SIG pass of the 3rd bit plane encodes, since the 3rd bit belongs to MR pass, it does not go into the candidate for coding. Therefore, the value after a cut-off will be set to "000010110002= 8810", if it is set to "000010100002= 8010" and this value is

reverse-quantized on the mid point.

[0123]

In addition, each bit plane is encoded in order of SIG pass, MR pass, and CL pass because the coding effectiveness over distortion of SIG pass is the highest. The rate and distortion property in each coding pass are shown in drawing 17 . The parts of MR pass and points P3-P4 show [the part of points P1-P2 / the parts of SIG pass and points P2-P3] CL pass among the R-D curve. If ratio delta DSIG/delta RSIG of the distortion to the rate (the amount of signs) in each coding pass, delta DMR/delta RMR, and delta DCL/delta RCL are seen, it turns out that the curvilinear inclination in SIG pass is the most sudden, and coding effectiveness is the highest.

[0124]

As mentioned above, in the image quality control processing concerning this operation gestalt, it is determined to the transform coefficient which carried out the bit shift according to the priority whether make a transform coefficient applicable to coding. Since only the candidate for coding is chosen, it is possible to control the amount of signs efficiently so that a high-definition compression image with little distortion can be generated.

[0125]

The amount control processing of signs

Next, the contents of processing of the amount control section 11 of signs shown in drawing 2 are explained. The amount control section 11 of signs computes the subtotal of the capacity of the compression coded data contained in an input bit stream per a band component unit, a bit plane unit, and coding pass.

[0126]

From the sign train which rearranged in order of the scan explained below, and was generated, said amount control section 11 of signs is omitted so that the amount of target signs may be suited, and it computes a point (truncation point). Next, the amount control section 11 of signs outputs the read-out control signal CS 1 to MMU3 so that the sign train may close, it may throw away and the sign train before a point may be read.

[0127]

Drawing 18 and drawing 19 are drawings for omitting with said scan sequence and explaining an example of a point. The transform coefficients 33 and 33 and -- by which the bit shift was carried out under the same regulation as having been shown in drawing 13 according to the priority are displayed on drawing 18

and drawing 19 .

[0128]

it is shown in the arrow head of drawing 18 -- as -- transform coefficients 33 and 33 and -- a bit plane unit or a coding pass unit -- it is -- order with a high priority -- and (turning to a lower bit from a high order bit) it is rearranged in order of the scan turned to the low-pass side from the high region side in the same priority. Generally, it is in the inclination for the rate of MR pass to increase and for compression efficiency to fall, so that a low-ranking bit plane is encoded. Therefore, in order to raise compression efficiency, the scan sequence turned to the low-pass side from the high region side in the same priority is adopted that as many SIG pass as possible should be encoded.

[0129]

And the amount control section 11 of signs is omitted so that the conditions from which the actual amount of signs (byte count) turns into below the amount of target signs (byte count) may be fulfilled, determines a point and omits the low order bit plane included in the sign train after the cut-off point concerned. Thereby, the amount control of signs of compression coded data can be efficiently performed according to the priority set as each subband. Here, as

shown in drawing 19 , when the 2nd bit plane of the subband HL3 omits according to the amount of target signs and it is determined as a point, the bit of the part shown by the arrow head will be omitted.

[0130]

Drawing showing the sign train into which drawing 20 was rearranged per bit plane, and drawing 21 are drawings showing the sign train rearranged per coding pass. In drawing 20 , the bit plane numbers 10 and 9 and -- are attached to each bit plane with the signs LL5 and HL5 and -- which show a subband. The bit plane after Rhine 44 given to the 2nd bit plane of the subband HL3 is omitted.

[0131]

Moreover, in drawing 21 , the bit plane numbers 10 and 9 and -- are attached to each coding pass with the signs CL, SIG, and MR which show the class of coding pass, the signs LL5 and HL5 which show a subband, and --. The bit plane after Rhine 44 given to MR pass of the 2nd bit plane of the subband HL3 is omitted.

[0132]

It is not necessary to use the deformation amount in each coding pass for a rate and distortion optimization processing, and according to the amount control

processing of signs which relates to this operation gestalt as mentioned above, real time nature is high and can realize the efficient amount control of signs with a low overhead.

[0133]

Layer division processing

Next, the actuation of the layer division control section 7 shown in drawing 2 is explained below. The layer division control section 7 changes the compression coded data contained in an input bit stream into the sign train which carried out the bit shift only of the number of bits corresponding to a priority using the priority data PS 2 acquired from the priority table 6, and has the control function which makes the sign train divide into two or more layers (multi-layer).

[0134]

Hereafter, layer division processing is explained. MMU3 stores an input bit stream in the mass storage 2 temporarily. The layer division control section 7 acquires the DS information DS on compression coded data from MMU41. Subsequently, the layer division control section 7 acquires the priority data PS 2 from the priority table 6, and only the predetermined number of bits shifts [control section] the transform coefficient of each band component of

compression coded data according to the priority included in this priority data PS 2. Thereby, a priority is set up to the transform coefficient of each band component. What is necessary is just to adopt the approach of the 1st above-mentioned example, the 2nd example, and the 3rd example as the setting approach of a priority.

[0135]

Drawing 22 is the transform coefficients 44 and 44 to which only the number of bits corresponding to a priority was shifted, and a mimetic diagram which illustrates --. the transform coefficients 44 and 44 of each band components LL5-HH1, and -- the number of bits of a priority -- a right bit shift -- or the left bit-shift is carried out. Moreover, the numbers 0, 1, --, 10 given to each bit of each transform coefficient 44 show the number of the bit plane with which the bit concerned belongs. here -- LSB number =0 and MSB number =10 -- it comes out.

[0136]

Next, the layer division control section 7 determines that a division location will carry out the group division of the coded data which carried out the bit shift at two or more layers in a bit plane unit or a coding pass unit based on layer

division information. As layer division information, the selection information as which it is made to choose any of a single layer and a multi-layer they are, the information which specifies a layer division location per a bit plane unit or coding pass are included. The division location which divides compression coded data into the layer 0 of five sheets - a layer 4 per bit plane is shown by the example of drawing 22 . And the layer division control section 7 supplies the read-out control signal CS 2 of the purport which reads data per layer according to the division location to MMU3. MMU3 reads from a high order layer in order according to the read-out control signal CS 2, covering [which were memorized by the store 2 / OD] them over a lower layer, and outputs them to the multiplexing section 5.

[0137]

In the above layer division processing, only the number of bits corresponding to the priority concerned carries out the bit shift of each band component, and a priority is set up. Thus, it is possible to generate efficiently two or more layers in a bit plane unit or a coding pass unit so that the distortion to a rate can be reduced by dividing into two or more layers the band component which carried out the bit shift. Therefore, there is not necessarily no need of performing layer division processing using above-mentioned rate and distortion optimization, and

it becomes possible to perform high layer division processing of real time nature so that distortion can be reduced.

[0138]

[Effect of the Invention]

According to the program concerning the amount control device of signs and claim 9 which start claim 1 of this invention like the above, it enables it for each band component to specify the candidate for coding efficiently according to the target image quality of a compression image, and to perform the high-speed amount control of signs in the small amount of operations, since the priority of a band component becomes settled according to the number of bits which only the number of bits corresponding to a priority is shifted, and is shifted.

[0139]

According to claim 2 and claim 10, it becomes possible to perform the amount control of signs so that high display image quality suitable for vision evaluation of human being may be realized.

[0140]

According to claim 3 and claim 11, according to target image quality, the amount of signs is efficiently [finely and] controllable per bit plane.

[0141]

According to claim 4 and claim 12, according to target image quality, the amount of signs is efficiently [finely and] controllable per coding pass.

[0142]

According to claims 5 and 6 and claims 13 and 14, it is possible to perform efficiently the amount control of signs of compression coded data according to the priority set as each band component, without decrypting the compression coded data concerned. Moreover, even if it does not use a rate and distortion optimization, it is not necessarily possible to perform the high amount control of signs of real time nature so that distortion can be controlled.

[0143]

Since the band component which carried out the bit shift according to the priority is divided into two or more layers according to claim 7 and claim 15, it is possible to generate two or more layers efficiently so that the distortion to a rate can be reduced.

[0144]

According to claim 8 and claim 16, it becomes possible to generate the compression image suitable for vision evaluation of human being which has high

display image quality.

[Brief Description of the Drawings]

[Drawing 1] It is the functional block diagram showing the outline configuration of the amount control device of signs concerning the operation gestalt of this invention.

[Drawing 2] It is the functional block diagram showing the outline configuration of the bit cut-off control section in the amount control device of signs shown in drawing 1 .

[Drawing 3] It is the mimetic diagram showing the two-dimensional image which carried out band division according to the octave division method.

[Drawing 4] It is drawing for explaining the priority setting processing by the bit shift.

[Drawing 5] It is drawing which illustrates the transform coefficient by which the bit shift was carried out.

[Drawing 6] It is the mimetic diagram showing the two-dimensional image which carried out band division by wavelet transform.

[Drawing 7] It is the mimetic diagram showing the two-dimensional image which carried out band division by wavelet transform.

[Drawing 8] It is the mimetic diagram showing the transform coefficient of the band component by which the right bit shift was carried out according to the priority shown in drawing 7 .

[Drawing 9] It is drawing showing the numerical table of Energy weighting factor.

[Drawing 10] It is drawing showing the numerical table of Energy weighting factor.

[Drawing 11] It is drawing showing the numerical table of Energy weighting factor.

[Drawing 12] It is the functional block diagram showing the outline configuration of the image quality control section concerning this operation gestalt.

[Drawing 13] It is the mimetic diagram which illustrates the transform coefficient by which the bit shift was carried out according to the priority.

[Drawing 14] It is drawing for explaining the example of processing of the transform coefficient of the band component LL 5.

[Drawing 15] It is drawing for explaining the example of processing of the transform coefficient of the band component LL 5.

[Drawing 16] It is drawing for explaining the example of coding processing of the transform coefficient of the band component HH2.

[Drawing 17] It is drawing showing the curve of a rate and a distortion property.

[Drawing 18] It is drawing for explaining an example of scan sequence.

[Drawing 19] It is drawing for explaining an example of a cut-off point.

[Drawing 20] It is drawing showing the sign train rearranged per bit plane.

[Drawing 21] It is drawing showing the sign train rearranged per coding pass.

[Drawing 22] It is the mimetic diagram which illustrates the coded data divided into two or more layers.

[Drawing 23] It is the functional block diagram showing the outline configuration of the compression coding equipment by JPEG2000 method.

[Drawing 24] It is the mimetic diagram showing the two-dimensional image by which band division was carried out according to the octave division method.

[Drawing 25] It is the mimetic diagram showing the two-dimensional image disassembled into two or more code blocks.

[Drawing 26] It is the mimetic diagram showing the bit plane of two or more sheets which constitutes a code block.

[Drawing 27] It is the mimetic diagram showing three kinds of coding pass.

[Description of Notations]

1 The Amount Control Unit of Signs

2 Storage

3 MMU

4 Bit Cut-off Control Section

5 Multiplexing Section

6 Priority Table

7 Layer Division Control Section

10 Image Quality Control Section

11 The Amount Control Section of Signs

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is the functional block diagram showing the outline configuration of the amount control device of signs concerning the operation gestalt of this invention.

[Drawing 2] It is the functional block diagram showing the outline configuration of the bit cut-off control section in the amount control device of signs shown in drawing 1 .

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[Drawing 6] It is the mimetic diagram showing the two-dimensional image which carried out band division by wavelet transform.

[Drawing 7] It is the mimetic diagram showing the two-dimensional image which carried out band division by wavelet transform.

[Drawing 8] It is the mimetic diagram showing the transform coefficient of the band component by which the right bit shift was carried out according to the priority shown in drawing 7 .

[Drawing 9] It is drawing showing the numerical table of Energy weighting factor.

[Drawing 10] It is drawing showing the numerical table of Energy weighting factor.

[Drawing 11] It is drawing showing the numerical table of Energy weighting factor.

[Drawing 12] It is the functional block diagram showing the outline configuration of the image quality control section concerning this operation gestalt.

[Drawing 13] It is the mimetic diagram which illustrates the transform coefficient by which the bit shift was carried out according to the priority.

[Drawing 14] It is drawing for explaining the example of processing of the transform coefficient of the band component LL 5.

[Drawing 15] It is drawing for explaining the example of processing of the transform coefficient of the band component LL 5.

[Drawing 16] It is drawing for explaining the example of coding processing of the transform coefficient of the band component HH2.

[Drawing 17] It is drawing showing the curve of a rate and a distortion property.

[Drawing 18] It is drawing for explaining an example of scan sequence.

[Drawing 19] It is drawing for explaining an example of a cut-off point.

[Drawing 20] It is drawing showing the sign train rearranged per bit plane.

[Drawing 21] It is drawing showing the sign train rearranged per coding pass.

[Drawing 22] It is the mimetic diagram which illustrates the coded data divided into two or more layers.

[Drawing 23] It is the functional block diagram showing the outline configuration of the compression coding equipment by JPEG2000 method.

[Drawing 24] It is the mimetic diagram showing the two-dimensional image by which band division was carried out according to the octave division method.

[Drawing 25] It is the mimetic diagram showing the two-dimensional image disassembled into two or more code blocks.

[Drawing 26] It is the mimetic diagram showing the bit plane of two or more sheets which constitutes a code block.

[Drawing 27] It is the mimetic diagram showing three kinds of coding pass.

[Description of Notations]

1 The Amount Control Unit of Signs

2 Storage

3 MMU

4 Bit Cut-off Control Section

5 Multiplexing Section

6 Priority Table

7 Layer Division Control Section

10 Image Quality Control Section

11 The Amount Control Section of Signs